

## Cytological Studies of Seven Taxa of Cyperaceae Collected from the Bonin (Ogasawara) Islands

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Seven taxa of Cyperaceae collected from the Bonin Islands were used for karyomorphological studies. Chromosome numbers are reported for *Carex hattoriana* ( $2n = 62$ ), *C. toyoshimae* ( $2n = 62$ ), *Fimbristylis longispica* var. *boninensis* ( $2n = 30$ ), *F. longispica* var. *hahajimensis* ( $2n = 30$ ), *Rhynchospora chinensis* var. *curvoaristata* ( $2n = 36$ ) and *R. boninensis* ( $2n = 20$ ) for the first time. These six taxa are endemic to the Bonin Islands. Our finding of  $2n = 82$  for *Actinoscirpus grossus* differs from that of a previous study. The chromosome number of *R. chinensis* var. *chinensis* was previously reported as  $2n = 62$ , and our results suggest that this number might have arisen by chromosome duplication of  $2n = 36$  in *R. chinensis* var. *curvoaristata*.

**Key words:** Bonin Islands, chromosome number, Cyperaceae, diffuse centromeric chromosome, endemic species.

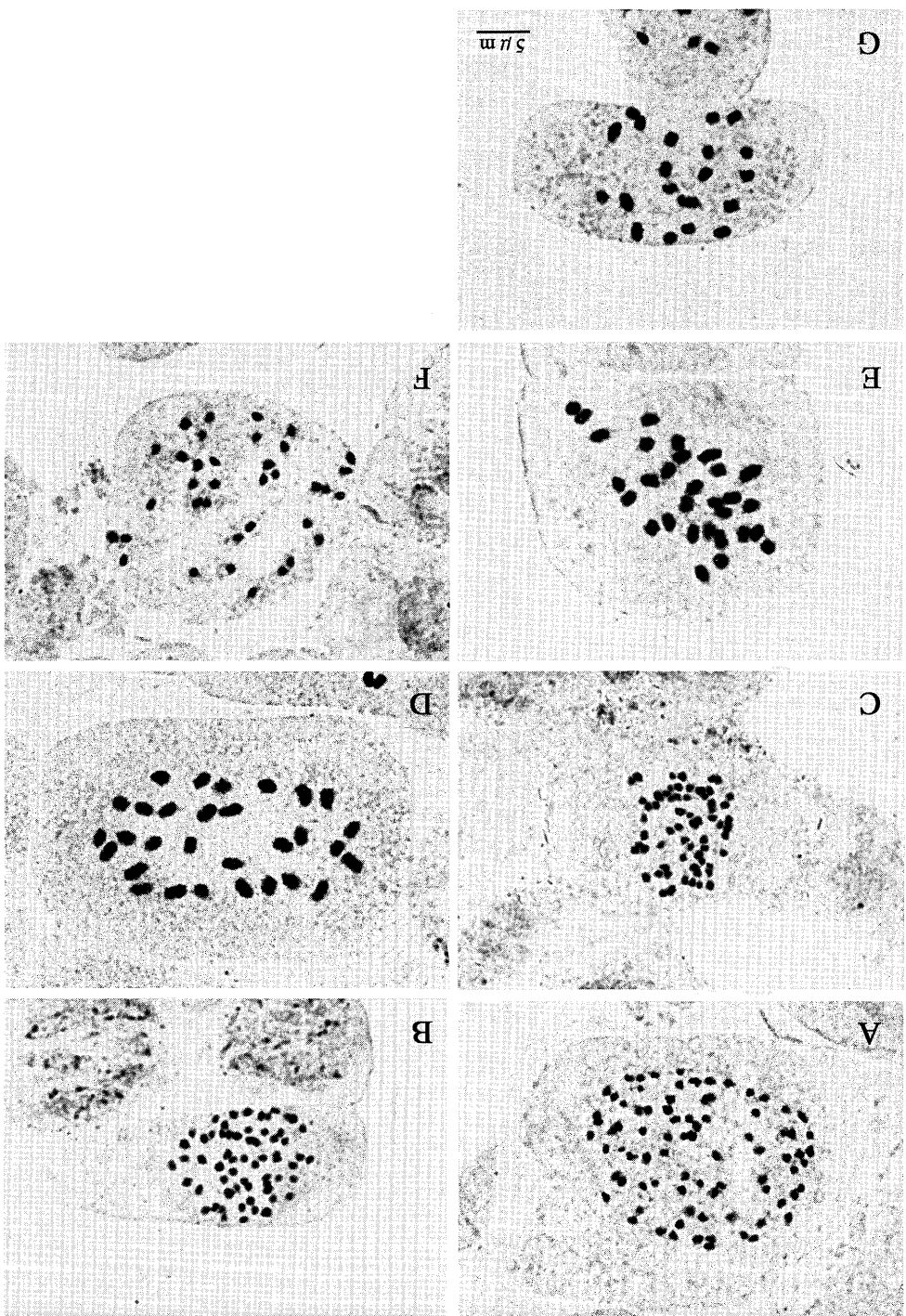
The Bonin Islands are typical oceanic islands, and are located 1,000 km south of Tokyo, Japan, in the western Pacific Ocean (Ito 1998). Many vascular plants endemic to the Islands have been reported (Ono et al. 1986), including those from the family Cyperaceae. Cyperaceae includes over 5000 species (Goetghebeur 1998). Thirty-four species of Cyperaceae have been reported for the Bonin Island, of which six species are endemic to the islands (Toyoda 2003). Koyama (1990) reported sixty-nine species of Cyperaceae in the Hawaiian Islands, of which seventeen species are endemic. The level of endemism of Cyperaceae in the Bonin Islands is almost same as in the Hawaiian Islands. Cytological studies of the endemic species of Cyperaceae in the Bonin Islands are important for understanding the evolution and diversification of this family in

oceanic islands. However, there has been no report on cytological study of Cyperaceae in the Bonin Islands. The purpose of this paper is to report the chromosome numbers of seven taxa of Cyperaceae from the Bonin Islands, and to clarify the cytological relationships of allied species.

### Materials and Methods

Seven taxa of Cyperaceae collected from the Bonin Islands were used for karyomorphological observations. The materials examined are listed in Table 1, of which the following six taxa are reported to be endemic to the Bonin Islands: *Carex hattoriana*, *C. toyoshimae*, *Fimbristylis longispica* var. *boninensis*, *F. longispica* var. *hahajimensis*, *Rhynchospora chinensis* var. *curvoaristata* and *R. boninensis* (Toyoda 2003). Somatic chromosomes were observed in the meriste-

Fig. 1. Photomicrographs of somatic metaphase chromosomes of seven taxa of Cyperaceae from the Bonin Islands. A. *Actinoscirpus grossus* (2n = 82). B. *Carex hattoriaana* (2n = 62). C. *C. toyoshimae* (2n = 62). D. *Fimbristylis longispica* var. *boninensis* (2n = 30). E. *F. longispica* var. *hahajimensis* (2n = 30). F. *Rhynchospora chinensis* var. *curvoaristata* (2n = 36). G. *R. boninensis* (2n = 20).



matic cells of root tips. The root tips were pretreated in 0.002 M 8-hydroxyquinoline solution for 1 h at 23°C and 15 h at 4°C. They were fixed in acetic alcohol (1:3) for over 16 h at -20°C or for 1.5 h at 23°C, stained by Feulgen's nuclear reaction, macerated in a mixture of 2 % pectinase and 2 % cellulase for 1 h at 37°C, restained in 1 % aceto-orcein and squashed. Voucher specimens were deposited in the Herbaria of Kanagawa Prefectural Museum of Natural History (KPM) and Okayama University of Science (OKAY).

### Results and Discussion

The chromosome numbers determined in this study are shown in Table 1. Primary constriction was not observed in any species.

*Actinoscirpus grossus* had the chromosome number of  $2n = 82$ , and all somatic metaphase chromosomes were less than 0.8  $\mu\text{m}$  in length (Fig. 1A). *Actinoscirpus grossus* collected from India was reported as  $2n = \text{ca. } 88$  by Rath and Patnaik (1978). The  $2n = 82$  of *A. grossus* from the Bonin Islands

may be an intraspecific aneuploid, which is common in Cyperaceae plants with diffuse centromeric chromosomes (Goetghebeur 1998).

*Carex hattoriana* had the chromosome number of  $2n = 62$ , and the somatic metaphase chromosomes were less than 0.8  $\mu\text{m}$  in length (Fig. 1B). *Carex hattoriana* belongs to section Graciles, and is closely related to *C. brunnea* (Ohwi 1936). The chromosome number of *C. brunnea* was reported as  $2n = 62$  by Tanaka (1948). Our results support the close relationship between these two species.

*Carex toyoshimae* had the chromosome number of  $2n = 62$ , and the somatic metaphase chromosomes were less than 0.8  $\mu\text{m}$  in length (Fig. 1C).

*Fimbristylis longispica* var. *boninensis* had the chromosome number of  $2n = 30$ . The somatic metaphase chromosomes ranged from 1.2 to 2.2  $\mu\text{m}$  in length (Fig. 1D). *Fimbristylis longispica* var. *hahajimensis* also had  $2n = 30$ . The somatic metaphase chromosomes ranged from 1.2 to 2.1  $\mu\text{m}$  in length (Fig. 1E). Morphologically, these two

Table 1. Taxa, locality and voucher, and chromosome numbers of seven taxa of Cyperaceae collected from the Bonin Islands

Taxa	Locality and Voucher	Chromosome number (2n)
<i>Actinoscirpus grossus</i> (L. f.) Goetghebeur & D. A. Simpson		
	Haha-jima, Pond Hasu; Katsuyama & al. 19915 (OKAY)	82
<i>Carex hattoriana</i> Nakai		
	Haha-jima, Mt. Tibusa; Katsuyama & al. 19913 (OKAY)	62
<i>C. toyoshimae</i> Tuyama		
	Haha-jima, Mt. Kuwanoki; Katsuyama & al. 19917 (OKAY)	62
	Haha-jima, Sekimon; Katsuyama & al. 19918 (OKAY)	62
<i>Fimbristylis longispica</i> Steud. var. <i>boninensis</i> (Hayata) Ohwi		
	Haha-jima, Mt. Tibusa; Katsuyama & al. 19911 (OKAY)	30
	Chichi-jima, Kominato; Katsuyama & al. 19920 (OKAY)	30
<i>F. longispica</i> Steud. var. <i>hahajimensis</i> (Tuyama) Ohwi		
	Haha-jima, Mt. Kensaki; Katsuyama & al. 19910 (OKAY)	30
	Haha-jima, Mt. Cyouki; Katsuyama & al. 19914 (OKAY)	30
<i>Rhynchospora boninensis</i> Nakai ex Tuyama		
	Chichi-jima, Higashi-daira; Katsuyama & al. 19872 (OKAY)	20
<i>R. chinensis</i> Nees & Meyen var. <i>curvoaristata</i> (Tuyama) Ohwi		
	Chichi-jima, Higashi-daira; Katsuyama & al. 19871 (OKAY)	36

varieties were mainly separated by the width of their leaves; 4–5 mm in *Fimbristylis longispica* var. *boninensis* and 1–1.5 mm in *F. longispica* var. *hahajimensis*. There were no karyomorphological differences between these two varieties.

*Rhynchospora chinensis* var. *curvoaristata* had  $2n = 36$ . The somatic metaphase chromosomes ranged from 0.6 to 1.1  $\mu\text{m}$  in length (Fig. 1F). The chromosome number of *R. chinensis* var. *chinensis* was reported as  $2n = 62$  by Tanaka (1948) and Hoshino (1987). Hoshino (1987) reported that *R. chinensis* var. *chinensis* collected from Okayama Pref., Japan was  $2n = 62$ , and that the metaphase chromosomes ranged from 0.8 to 1.9  $\mu\text{m}$  in length. In *Carex*, when the chromosome number increases by aneuploidy, both the lengths and widths of all chromosomes tend to become smaller (Hoshino 1981). The aneuploidy of *Carex* was reported as agmatoploidy (chromosome fragmentation) (Devies 1956). In our study, the chromosome sizes of *R. chinensis* var. *chinensis* ( $2n = 62$ ) and *R. chinensis* var. *curvoaristata* ( $2n = 36$ ) were found to be almost equal. Our results suggest that the  $2n = 62$  of *R. chinensis* var. *chinensis* might have arisen by chromosome duplication, and not agmatoploidy from a certain ancestor with smaller chromosome numbers such as *R. chinensis* var. *curvoaristata*.

*Rhynchospora boninensis* had  $2n = 20$ . The somatic metaphase chromosomes ranged from 1.1 to 1.8  $\mu\text{m}$  in length (Fig. 1G). Ohwi (1943) reported that *R. boninensis* is closely related to *R. rubra*, sharing a globular terminal capitulum. The chromosome number of *R. rubra* was reported as  $2n = 20$  by Hoshino (1987). Our results also support a close relationship between these two species.

The chromosome numbers of *Carex hattoriana* ( $2n = 62$ ), *C. toyoshimae* ( $2n = 62$ ), *Fimbristylis longispica* var. *boninensis* ( $2n = 30$ ), *F. longispica* var. *hahajimensis* ( $2n = 30$ ), *Rhynchospora chinensis* var.

*curvoaristata* ( $2n = 36$ ) and *R. boninensis* ( $2n = 20$ ), were determined for the first time in this study. Two endemic species to the Bonin Islands, *C. hattoriana* and *R. boninensis* had the same chromosome number as their morphologically closely related species. *Rhynchospora chinensis* var. *curvoaristata* is closely related to *R. chinensis* var. *chinensis* and chromosome duplication was found between these two taxa.

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# 矢野興一<sup>a</sup>, 勝山輝男<sup>b</sup>, 星野卓二<sup>a</sup>: 小笠原諸島産 カヤツリグサ科植物 7 分類群の細胞学的研究

小笠原諸島より採集したカヤツリグサ科植物 7 分類群について染色体数を報告した。このうち小笠原諸島に固有の 6 分類群については今回が初めての報告である。ムニンナキリスゲ (*Carex hattoriana*) とセキモンスゲ (*C. toyoshimae*) が  $2n=62$ , ムニンテンツキ (*Fimbristylis longispica* var. *boninensis*) とハハジマテンツキ (*F. longispica* var. *hahajimensis*) が  $2n=30$ , ムニンイヌノハナヒゲ (*Rhynchospora chinensis* var. *curvoaristata*) が  $2n=36$ , シマイガクサ (*R. boninensis*) が  $2n=20$  であった。オオサンカクイ (*Actinoscirpus grossus*) では  $2n=82$  を観察し、従来の報告  $2n=$

ca. 88 (Rath and Patnaik 1978) とは異なった染色体数が観察された。小笠原固有のムニンイヌノハナヒゲ (*R. chinensis* var. *curvoaristata*) は  $2n=36$  であるが、近縁種とされているイヌノハナヒゲ (*R. chinensis* var. *chinensis*) は  $2n=62$  (Hoshino 1987) と異なっていた。この二変種は、染色体の大きさがほとんど同じであることから、イヌノハナヒゲでは染色体の重複による核型の分化がおこっていると考えられる。

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